

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings of claims in the application:

Listing of Claims:

Please cancel claims 1-120 and 121-128. Please insert new claims 129-202.

The list of currently pending claims is presented below.

1 **Claims 1.-120.** (Canceled)

1 **Claims 121-128.** (Canceled)

1 **Claim 129.** (New) A device comprising:

2 a first substrate having a surface;

3 a second substrate having a surface, said first substrate and said second substrate being

4 aligned such that said surface of said first substrate opposes said surface of said

5 second substrate;

6 a first organic layer attached to said surface of said first substrate, wherein said first

7 organic layer comprises a first recognition moiety; and

8 a mesogenic layer between said first substrate and said second substrate, said mesogenic

9 layer comprising a plurality of mesogenic compounds.

1 **Claim 130.** (New) The device according to claim 129, further comprising a second organic

2 layer attached to said second substrate.

1 **Claim 131.** (New) The device according to claim 130, wherein said second organic layer

2 comprises a second recognition moiety.

1 **Claim 132.** (New) The device according to claim 130, wherein said first recognition moiety

2 and said second recognition moiety are the same.

1 **Claim 133.** (New) The device according to claim 131, wherein said first recognition moiety

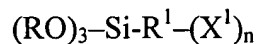
2 and said second recognition moiety are different.

1 **Claim 134.** (New) The device according to claim 129, wherein said organic layer comprises a
2 member selected from the group consisting of organosulfur, organosilanes, amphiphilic
3 molecules, cyclodextrins, polyols, fullerenes and biomolecules.

1 **Claim 135.** (New) The device according to claim 130, wherein said first organic layer and
2 said second organic layer are different.

1 **Claim 136.** (New) The device according to claim 130, wherein said first organic layer and
2 said second organic layer are the same.

1 **Claim 137.** (New) The device according to claim 129, wherein said organic layer comprises a
2 member selected from the group consisting of:



4 wherein,

5 R is an alkyl group;

6 R^1 is a linking group between silicon and X^1 ;

7 X^1 is a member selected from the group consisting of reactive groups and
8 protected reactive groups; and

9 n is a number between 1 and 50.

1 **Claim 138.** (New) The device according to claim 137, wherein R is a member selected from
2 the group consisting of methyl and ethyl groups.

1 **Claim 139.** (New) The device according to claim 137, wherein R^1 is a member selected from
2 the group consisting of stable linking groups and cleaveable linking groups.

1 **Claim 140.** (New) The device according to claim 139, wherein R^1 is a member selected from
2 the group consisting of alkyl, substituted alkyl, aryl, arylalkyl, substituted aryl, substituted
3 arylalkyl, saturated cyclic hydrocarbon, unsaturated cyclic hydrocarbon, heteroaryl,
4 heteroarylalkyl, substituted heteroaryl, substituted heteroarylalkyl, heterocyclic, substituted
5 heterocyclic and heterocyclicalkyl groups.

1 **Claim 141.** (New) The device according to claim **139**, wherein R¹ comprises a moiety which
2 is a member selected from group consisting of disulfide, ester, imide, carbonate, nitrobenzyl
3 phenacyl and benzoin groups.

1 **Claim 142.** (New) The device according to claim **139**, wherein R¹ is a member selected from
2 the group consisting of alkyl and substituted alkyl groups.

1 **Claim 143.** (New) The device according to claim **137**, wherein X¹ is a member selected from
2 the group consisting of carboxylic acid, carboxylic acid derivatives, hydroxyl, haloalkyl,
3 dienophile, carbonyl, sulfonyl halide, thiol, amine, sulfhydryl, alkene and epoxide groups.

1 **Claim 144.** (New) A method for detecting an analyte, comprising:
2 contacting with said analyte a recognition moiety for said analyte, wherein said
3 contacting causes at least a portion of a plurality of mesogens proximate to said
4 recognition moiety to detectably switch from a first orientation to a second orientation
5 upon contacting said analyte with said recognition moiety; and
6 detecting said second orientation of said at least a portion of said plurality of mesogens,
7 whereby said analyte is detected.

1 **Claim 145.** (New) The method according to claim **144**, wherein said analyte is a member
2 selected from the group consisting of vapors, gases and liquids.

1 **Claim 146.** (New) The method according to claim **145**, wherein said vapor is a member
2 selected from the group consisting of vapors of a single compound and vapors of a
3 mixture of compounds.

1 **Claim 147.** (New) The method of claim **145**, wherein said gas is a member selected from the
2 group consisting of a single gaseous compound and mixtures of gaseous compounds.

1 **Claim 148.** (New) The method of claim **145**, wherein said liquid is a member selected from
2 the group consisting of a single liquid compound, mixtures of liquid compounds, solutions of
3 solid compounds and solutions of gaseous compounds.

1 **Claim 149.** (New) The method according to claim 144, wherein said recognition moiety
2 comprises a member selected from the group consisting of metal ions, metal-binding ligands,
3 metal-ligand complexes, nucleic acids, peptides, cyclodextrins, acids, bases, antibodies,
4 enzymes and combinations thereof.

1 **Claim 150.** (New) The method according to claim 144, wherein from about 10 to about 10^8
2 mesogens undergo said switching for each molecule of analyte interacting with said analyte.

1 **Claim 151.** (New) The method according to claim 144, wherein from about 10^3 to about 10^6
2 mesogens undergo said switching.

1 **Claim 152.** (New) The method according to claim 144, wherein said first orientation is a
2 member selected from the group consisting of uniform, twisted, isotropic and nematic and said
3 second orientation is a member selected from the group consisting of uniform, twisted, isotropic
4 and nematic, with the proviso that said first orientation and said second orientation are different
5 orientations.

1 **Claim 153.** (New) The method according to claim 152, wherein said detecting is achieved by
2 a method selected from the group consisting of visual observation, microscopy, spectroscopic
3 technique, electronic techniques and combinations thereof.

1 **Claim 154.** (New) The method according to claim 152, wherein said visual observation
2 detects a change in reflectance, transmission, absorbance, dispersion, diffraction, polarization
3 and combinations thereof, of light impinging on said plurality of mesogens.

1 **Claim 155.** (New) The method according to claim 153, wherein said microscopy is a member
2 selected from the group consisting of light microscopy, polarized light microscopy, atomic force
3 microscopy, scanning tunneling microscopy and combinations thereof.

1 **Claim 156.** (New) The method according to claim 153, wherein said spectroscopic technique
2 is a member selected from the group consisting of infrared spectroscopy, Raman spectroscopy,
3 x-ray spectroscopy, visible light spectroscopy, ultraviolet spectroscopy and combinations
4 thereof.

1 **Claim 157.** (New) The method according to claim **153**, wherein said electronic technique is a
2 member selected from the group consisting of surface plasmon resonance, ellipsometry,
3 impedometric methods and combinations thereof.

1 **Claim 158.** (New) A device comprising:
2 a first substrate having a first surface;
3 a second substrate having a second surface, said first substrate and said second substrate
4 being aligned such that said first surface opposes said first substrate opposes said
5 second surface of said second substrate;
6 a first organic layer attached to said first surface, wherein said first organic layer
7 comprises a first recognition moiety which is bound to said first organic layer,
8 interacts with said analyte, and is selected from a peptide, protein, enzyme, and
9 receptor;
10 a mesogenic layer between said first substrate and said second substrate, said mesogenic
11 layer comprising a plurality of mesogenic compounds.

1 **Claim 159.** (New) The device according to claim **158**, further comprising an interior portion
2 defined as the area between said first surface and said second surface, wherein said
3 interior portion allows communication between said analyte and said recognition moiety.

1 **Claim 160.** (New) The device according to claim **158**, wherein said organic layer is a rubbed
2 polymer.

1 **Claim 161.** (New) The device according to claim **158**, wherein said recognition moiety
2 further comprises a biomolecule comprising a member selected from a polysaccharide
3 and a combination of a polysaccharide and a protein.

1 **Claim 162.** (New) The device according to claim **158**, wherein said first organic layer
2 comprises a self-assembled organosulfur or organosilane monolayer bound to said first
3 surface; and wherein said first recognition moiety is bound to said self-assembled
4 monolayer.

1 **Claim 163.** (New) A device for detecting an interaction between an analyte and a first or
2 second recognition moiety, said device comprising:
3 a first substrate having a first surface;
4 a first organic layer attached to said first surface, wherein said first organic layer
5 comprises a first recognition moiety which is bound to said first organic layer,
6 interacts with said analyte, and is selected from a peptide, protein, enzyme, and
7 receptor; and
8 a second substrate having a second surface, said first substrate and said second substrate
9 being aligned such that said first surface opposes said second surface;
10 a second organic layer attached to said first surface, wherein said second organic layer
11 comprises a second recognition moiety, bound to said first organic layer, which
12 interacts with said analyte, wherein said second recognition moiety is selected from
13 an amine, a carboxylic acid, a biomolecule, a drug moiety, a chelating agent, a crown
14 ether, and a cyclodextrin; and
15 a mesogenic layer between said first substrate and said second substrate, said mesogenic
16 layer comprising a plurality of mesogens, wherein at least a portion of said plurality
17 of mesogens undergo a detectable switch in orientation upon interaction between said
18 first recognition moiety and said analyte, whereby said analyte is detected.

1 **Claim 164.** (New) The device according to claim 163, wherein said analyte is a member
2 selected from the group consisting of acids, bases, avidin, organic ions, inorganic ions,
3 pharmaceuticals, herbicides, pesticides, agents of war, noxious gases, biomolecules and
4 combinations thereof.

1 **Claim 165.** (New) The device according to claim 163, wherein said interaction is a member
2 selected from the group consisting of covalent bonding, ionic bonding, hydrogen
3 bonding, van der Waals interactions, repulsive electronic interactions, attractive
4 electronic interactions, hydrophobic interactions, hydrophilic interactions and
5 combinations thereof.

1 **Claim 166.** (New) The device according to claim 163, wherein said first organic layer
2 comprises a self-assembled organosulfur or organosilane monolayer bound to said first
3 surface; and wherein said first recognition moiety is bound to said self-assembled
4 monolayer.

1 **Claim 167.** (New) The device according to claim 163, wherein said second organic layer
2 comprises a self-assembled organosulfur or organosilane monolayer bound to said second
3 substrate; and wherein said second recognition moiety is bound to said self-assembled
4 monolayer.

1 **Claim 168.** (New) A device for detecting an interaction between an analyte and a first or
2 second recognition moiety, said device comprising:
3 a first substrate having a first surface;
4 a first organic layer attached to said first surface, wherein said first organic layer
5 comprises a first recognition moiety which is bound to said first organic layer,
6 interacts with said analyte, and is selected from a peptide, protein, enzyme, and
7 receptor; and
8 a second substrate having a second surface, said first substrate and said second substrate
9 being aligned such that said first surface opposes said second surface;
10 a second organic layer attached to said first surface, wherein said second organic layer
11 comprises a second recognition moiety, bound to said first organic layer, which
12 interacts with said analyte, wherein said second recognition moiety is selected from a
13 peptide, protein, enzyme, and receptor; and
14 a mesogenic layer between said first substrate and said second substrate, said mesogenic
15 layer comprising a plurality of mesogens, wherein at least a portion of said plurality
16 of mesogens undergo a detectable switch in orientation upon interaction between said
17 first recognition moiety and said analyte, whereby said analyte is detected.

1 **Claim 169.** (New) The device according to claim 168, wherein said analyte is a member
2 selected from the group consisting of acids, bases, avidin, organic ions, inorganic ions,

3 pharmaceuticals, herbicides, pesticides, agents of war, noxious gases, biomolecules and
4 combinations thereof.

1 **Claim 170.** (New) The device according to claim 168, wherein said interaction is a member
2 selected from the group consisting of covalent bonding, ionic bonding, hydrogen
3 bonding, van der Waals interactions, repulsive electronic interactions, attractive
4 electronic interactions, hydrophobic interactions, hydrophilic interactions and
5 combinations thereof.

1 **Claim 171.** (New) The device according to claim 168, wherein said first organic layer
2 comprises a self-assembled organosulfur or organosilane monolayer bound to said first
3 surface; and wherein said first recognition moiety is bound to said self-assembled
4 monolayer.

1 **Claim 172.** (New) The device according to claim 168, wherein said second organic layer
2 comprises a self-assembled organosulfur or organosilane monolayer bound to said second
3 substrate; and wherein said second recognition moiety is bound to said self-assembled
4 monolayer.

1 **Claim 173.** (New) A device for detecting an interaction between an analyte and a first or
2 second recognition moiety, said device comprising:
3 a first substrate having a first surface;
4 a first organic layer attached to said first surface wherein said first organic layer
5 comprises a first recognition moiety which is bound to said first organic layer and
6 interacts with said analyte; and
7 a second substrate having a second surface, said first substrate and said second substrate
8 being aligned such that said first surface opposes said second surface;
9 a second organic layer attached to said first surface, wherein said second organic layer
10 comprises a second recognition moiety which is bound to said second organic layer
11 and interacts with said analyte; and
12 a mesogenic layer between said first substrate and said second substrate, said mesogenic
13 layer comprising a plurality of mesogens, wherein at least a portion of said plurality

14 of mesogens undergo a detectable switch in orientation upon interaction between said
15 first recognition moiety and said analyte, whereby said analyte is detected.

1 **Claim 174.** (New) The device according to claim 173, wherein said analyte is a member
2 selected from the group consisting of acids, bases, avidin, organic ions, inorganic ions,
3 pharmaceuticals, herbicides, pesticides, agents of war, noxious gases, biomolecules and
4 combinations thereof.

1 **Claim 175.** (New) The device according to claim 173, wherein said interaction is a member
2 selected from the group consisting of covalent bonding, ionic bonding, hydrogen
3 bonding, van der Waals interactions, repulsive electronic interactions, attractive
4 electronic interactions, hydrophobic interactions, hydrophilic interactions and
5 combinations thereof.

1 **Claim 176.** (New) The device according to claim 173, wherein said first organic layer
2 comprises a self-assembled organosulfur or organosilane monolayer bound to said first
3 surface; and wherein said first recognition moiety is bound to said self-assembled
4 monolayer.

1 **Claim 177.** (New) The device according to claim 173, wherein said second organic layer
2 comprises a self-assembled organosulfur or organosilane monolayer bound to said second
3 substrate; and wherein said second recognition moiety is bound to said self-assembled
4 monolayer.

1 **Claim 178.** (New) The device according to claim 173, wherein said first organic layer
2 comprises a self-assembled organosulfur or organosilane monolayer bound to said first
3 surface; and wherein said first recognition moiety is bound to said self-assembled
4 monolayer.

1 **Claim 179.** (New) A device comprising:
2 a first substrate having a surface, wherein said surface comprises a recognition moiety,
3 and said recognition moiety and said first substrate are joined through a member
4 selected from direct attachment and indirect attachment through a spacer arm;

5 a mesogenic layer oriented on said surface; and
6 an interface between said mesogenic layer and a member selected from the group
7 consisting of gases, liquids, solids and combinations thereof.

1 **Claim 180.** (New) The device of claim 179, wherein said recognition moiety and said first
2 substrate are joined through direct attachment, and said direct attachment is through a member
3 selected from covalent bonding, ionic bonding, chemisorption, physisorption and combinations
4 thereof.

1 **Claim 181.** (New) The device of claim 179, wherein said recognition moiety and said first
2 substrate are joined through indirect attachment through a spacer arm, and wherein said spacer
3 arm comprises a member selected from the group consisting of poly(ethyleneglycol),
4 poly(propyleneglycol), diamines, and surface-active agents.

1 **Claim 182.** (New) A device comprising:
2 a first substrate having a surface, wherein said surface comprises a recognition moiety,
3 and said recognition moiety and said first substrate are joined through a member
4 selected from direct attachment and indirect attachment through a spacer arm;
5 a second substrate having a second surface, said first substrate and said second substrate
6 being aligned such that said first surface opposes said second surface;
7 a mesogenic layer oriented on said surface; and
8 an interface between said mesogenic layer and a member selected from the group
9 consisting of gases, liquids, solids and combinations thereof.

1 **Claim 183.** (New) The device of claim 182, wherein said recognition moiety and said first
2 substrate are joined through direct attachment, and said direct attachment is through a member
3 selected from covalent bonding, ionic bonding, chemisorption, physisorption and combinations
4 thereof.

1 **Claim 184.** (New) The device of claim 182, wherein said recognition moiety and said first
2 substrate are joined through indirect attachment through a spacer arm, and wherein said spacer
3 arm comprises a member selected from the group consisting of poly(ethyleneglycol),
4 poly(propyleneglycol), diamines, and surface-active agents.

1 **Claim 185.** (New) A method for measuring the affinity of a recognition moiety for an analyte
2 of interest over a pre-bound analyte, said method comprising:

3 (a) contacting a first analyte with a recognition moiety for said first analyte, thus forming
4 a pre-bound analyte

5 wherein said contacting causes at least a portion of a plurality of mesogens proximate to
6 said recognition moiety to detectably switch from a first orientation to a second
7 orientation upon contacting said first analyte with said recognition moiety;

8 (b) detecting said second orientation of said at least a portion of said plurality of
9 mesogens;

10 (c) contacting said analyte of interest with said recognition moiety, wherein said
11 contacting causes at least a portion of a plurality of mesogens proximate to said
12 recognition moiety to detectably switch from the second orientation to a third
13 orientation upon contacting said analyte of interest with said recognition moiety;
14 and

15 (d) detecting the third orientation of said at least a portion of said plurality of mesogens,
16 whereby the affinity of the recognition moiety for the analyte of interest over the
17 pre-bound analyte is measured.

1 **Claim 186.** (New) A device for amplifying an interaction between a first recognition moiety
2 and an analyte of interest, said device comprising:

3 a first substrate having a surface;

4 a first organic layer attached to said surface of said first substrate;

5 wherein said first recognition moiety is capable of interacting with an analyte of interest
6 to form a first recognition moiety-analyte of interest complex; and

7 a mesogenic layer comprising a liquid crystalline material, wherein said mesogenic layer
8 is in contact with said first recognition moiety, and the formation of said complex

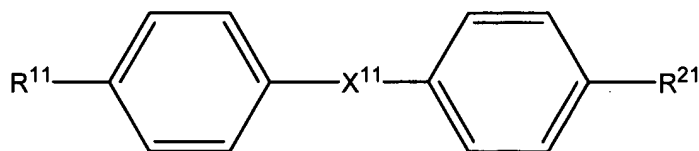
induces a rearrangement in a conformation of said mesogenic layer, and wherein said mesogenic layer amplifies said interaction.

Claim 187. (New) The device of claim 186, wherein the first recognition moiety is an antibody.

Claim 188. (New) The device of claim 186, wherein the analyte of interest is selected from a biomolecule, chemical warfare agent, and noxious gas.

Claim 189. (New) The device of claim 186, wherein said rearrangement of said mesogenic layer produces an optical signal.

Claim 190. (New) A copper(II)-detecting device comprising:
a first substrate having a surface;
a second substrate having a surface, said first substrate and said second substrate being aligned such that said surface of said first substrate opposes said surface of said second substrate;
a first organic layer attached to said surface of said first substrate, wherein said first organic layer comprises a first recognition moiety; and
a mesogenic layer comprising a plurality of mesogenic compounds comprising a structure according to Formula X:



(X)

wherein

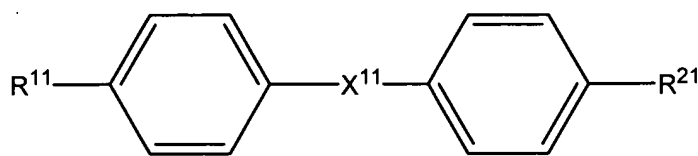
X¹¹ is a member selected from a bond, Schiff bases, diazo compounds, azoxy compounds, nitrones, alkenes, alkynes, and esters;

R¹¹ and R²¹ are members independently selected from substituted or unsubstituted alkyl, substituted or unsubstituted heteroalkyl, substituted or unsubstituted

cycloalkyl, substituted or unsubstituted heterocycloalkyl, substituted or unsubstituted aryl, substituted or unsubstituted heteroaryl, acyl, halogens, hydroxy, cyano, amino, alkoxy, mercapto, thia, and aza; wherein at least one of said R¹¹ and R²¹ is cyano.

Claim 191. (New) The copper(II)-detecting device of claim 190, wherein X¹¹ is a bond, R²¹ is pentyl, and R¹¹ is cyano.

Claim 192. (New) A sodium-detecting device comprising:
a first substrate having a surface;
a second substrate having a surface, said first substrate and said second substrate being aligned such that said surface of said first substrate opposes said surface of said second substrate;
a first organic layer attached to said surface of said first substrate, wherein said first organic layer comprises a first recognition moiety comprising a carboxylic acid moiety; and
a mesogenic layer comprising a plurality of mesogenic compounds comprising a structure according to Formula X:



(X)

wherein

X¹¹ is a member consisting of a bond, Schiff bases, diazo compounds, azoxy compounds, nitrones, alkenes, alkynes, and esters;

R¹¹ and R²¹ are members independently selected from substituted or unsubstituted alkyl, substituted or unsubstituted heteroalkyl, substituted or unsubstituted cycloalkyl, substituted or unsubstituted heterocycloalkyl, substituted or unsubstituted aryl, substituted or unsubstituted heteroaryl, acyl, halogens, hydroxy, cyano, amino, alkoxy, mercapto, thia, and aza;

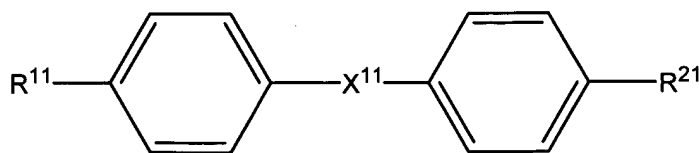
wherein at least one of said R¹¹ and R²¹ is a member selected from cyano, hydroxy, alkoxy, alkylamine, amine, mercapto, and thia.

Claim 193. (New) The sodium-detecting device of claim 192, wherein X¹¹ is a member selected from a bond and an alkene.

Claim 194. (New) The sodium-detecting device of claim 192, wherein R¹¹ is cyano and R²¹ is methoxy.

Claim 195. (New) The sodium-detecting device of claim 192, wherein R¹¹ is cyano and R²¹ is pentyl.

Claim 196. (New) A hexylamine-detecting device comprising:
a first substrate having a surface;
a second substrate having a surface, said first substrate and said second substrate being aligned such that said surface of said first substrate opposes said surface of said second substrate;
a first organic layer attached to said surface of said first substrate, wherein said first organic layer comprises a first recognition moiety comprising a carboxylic acid moiety; and
a mesogenic layer comprising a plurality of mesogenic compounds comprising a structure according to Formula X:



(X)

wherein
X¹¹ is a member consisting of a bond, Schiff bases, diazo compounds, azoxy compounds, nitrones, alkenes, alkynes, and esters;

15 R¹¹ and R²¹ are members independently selected from substituted or unsubstituted
16 alkyl, substituted or unsubstituted heteroalkyl, substituted or unsubstituted
17 cycloalkyl, substituted or unsubstituted heterocycloalkyl, substituted or
18 unsubstituted aryl, substituted or unsubstituted heteroaryl, acyl, halogens,
19 hydroxy, cyano, amino, alkoxy, mercapto, thia, and aza;
20 wherein at least one of said R¹¹ and R²¹ is a member selected from cyano,
21 hydroxy, alkoxy, alkylamine, amine, mercapto, and thia.

1 **Claim 197.** (New) The hexylamine-detecting device of claim 196, wherein X¹¹ is a member
2 selected from a bond and an alkene.

1 **Claim 198.** (New) The hexylamine-detecting device of claim 196, wherein R¹¹ is cyano and
2 R²¹ is methoxy.

1 **Claim 199.** (New) The hexylamine-detecting device of claim 196, wherein R¹¹ is cyano and
2 R²¹ is pentyl.

1 **Claim 200.** (New) A method of detecting an analyte, comprising:
2 (a) interacting said analyte with a surface comprising a recognition moiety, thereby
3 forming an analyte-recognition moiety complex, said surface comprising:
4 (i) a substrate;
5 (ii) an organic layer bound to said substrate; and
6 (iii) said recognition moiety bound to said organic layer;
7 (b) contacting said analyte-recognition moiety complex with a mesogenic layer, thereby
8 causing at least a portion of a plurality of mesogens proximate to said recognition
9 moiety to detectably switch from a first orientation to a second orientation, and
10 detecting said second orientation of said at least a portion of said plurality of mesogens, whereby
11 said analyte is detected.

1 **Claim 201.** (New) A method of detecting an analyte, comprising:

2 (a) interacting said analyte with a surface comprising said recognition moiety, said

3 surface comprising:

4 (i) a substrate;

5 (ii) an organic layer bound to said substrate; and

6 (iii) said recognition moiety bound to said organic layer;

7 (b) contacting said analyte with an organic mesogenic layer, thereby causing at least a

8 portion of a plurality of mesogens proximate to said recognition moiety to detectably

9 switch from a first orientation to a second orientation upon contacting said analyte

10 with said recognition moiety; and

11 detecting said second orientation of said at least a portion of said plurality of mesogens, whereby

12 said analyte is detected.

1 **Claim 202.** (New) A method for detecting an analyte, comprising:

2 interacting said analyte and a mesogenic layer, wherein said interacting causes at least a

3 portion of a plurality of mesogens to detectably switch from a first orientation to a

4 second orientation; and

5 detecting said second orientation of said at least a portion of said plurality of mesogens,

6 whereby said analyte is detected.